



INVESTIGATOR'S ANNUAL REPORT

United States Department of the Interior
National Park Service

All or some of the information you provide may become available to the public.

OMB # (1024-0236)
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Reporting Year: 2006	Park: Shenandoah NP	Select the type of permit this report addresses: Scientific Study										
Name of principal investigator or responsible official: Richard Challis		Office Phone: +44 131 650 5516										
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Additional investigators or key field assistants (first name, last name, office phone, office email) <table><tr><td>Name: Dr. Katherine Schick</td><td>Phone: 510 643-0804</td><td>Email: kaschick@berkeley.edu</td></tr><tr><td>Name: Mr. David Challis</td><td>Phone:</td><td>Email: dave@z6.com</td></tr><tr><td>Name: Dr. Graham Stone</td><td>Phone: +44 131 650 7194</td><td>Email: graham.stone@ed.ac.uk</td></tr></table>				Name: Dr. Katherine Schick	Phone: 510 643-0804	Email: kaschick@berkeley.edu	Name: Mr. David Challis	Phone:	Email: dave@z6.com	Name: Dr. Graham Stone	Phone: +44 131 650 7194	Email: graham.stone@ed.ac.uk
Name: Dr. Katherine Schick	Phone: 510 643-0804	Email: kaschick@berkeley.edu										
Name: Mr. David Challis	Phone:	Email: dave@z6.com										
Name: Dr. Graham Stone	Phone: +44 131 650 7194	Email: graham.stone@ed.ac.uk										
Project Title (maximum 300 characters): Biogeography and gall trait evolution in oak gallwasps (Hymenoptera: Cynipidae)												
Park-assigned Study or Activity #: SHEN-00304	Park-assigned Permit #: SHEN-2004-SCI-0019	Permit Start Date: Oct 01, 2004	Permit Expiration Date: Sep 30, 2006									
Scientific Study Starting Date: Oct 01, 2004		Estimated Scientific Study Ending Date: Dec 30, 2007										
For either a Scientific Study or a Science Education Activity, the status is: Continuing		For a Scientific Study that is completed, please check each of the following that applies: <input type="checkbox"/> A final report has been provided to the park or will be provided to the park within the next two years <input type="checkbox"/> Copies of field notes, data files, photos, or other study records, as agreed, have been provided to the park <input type="checkbox"/> All collected and retained specimens have been cataloged into the NPS catalog system and NPS has processed loan agreements as needed										
Activity Type: Research												
Subject/Discipline: Invertebrates (Insects, Other)												

Purpose of Scientific Study or Science Education Activity during the reporting year (maximum 4000 characters):

Gallwasps (Family Cynipidae) are parasitic hymenopterans that are capable of inducing the growth of abnormal structures (galls) on trees, shrubs or herbs. The oak gallwasp tribe, Cynipini, contains species that induce galls on oak (genus *Quercus*) and other Fagaceae and is distributed throughout the northern hemisphere. This is the most species rich tribe, with around 1000 species in 27 genera (Cska et al., 2004), and its members induce galls with greater variety and complexity than any other group of gall formers (Cornell, 1983). The adaptive significance of this morphological diversity remains largely untested; however, it is believed that certain traits offer protection from natural enemies (Stone and Schnroge, 2003). The principle aim of this investigation is to build a molecular phylogeny of the oak gallwasps to investigate patterns in host use and gall trait evolution and to trace historic dispersal events.

The need for taxonomic revision of the North American oak gallwasps was highlighted in a preliminary molecular phylogeny produced by Drown and Brown (1998). While this phylogeny lacked resolution, it demonstrated that several genera are in fact polyphyletic. A robust molecular phylogeny, based on several genes, produced from samples collected in his study, could provide a framework for taxonomic revision. It will allow the pattern and frequency of gall character evolution to be mapped, providing a first step toward understanding the selection pressures involved. By comparison with parasitoid communities and climatic data, it may prove possible to determine the most important selection pressures. Re-evolution of characters within one region that are absent from another region may suggest the action of unique selection pressures. With a global phylogeny it will be possible to test the hypothesis (based on the current distribution of diversity) that oak gallwasps diversified in North America and then spread across Asia to Europe. Of particular interest are the four Holarctic genera, *Andricus*, *Callirhytis*, *Dryocosmus* and *Neuroterus* since the distribution of these genera may represent separate dispersal events.

Since North America has the richest oak gallwasp fauna in the world, it will not be possible to sample all species. A set of species encompassing the diversity in gall traits and host use will be specifically targeted. While oak gallwasps may be found wherever oaks grow, some require different species as hosts for each stage of their lifecycle. As such, oak gallwasp diversity should be greater in areas such as National Parks where oak density and diversity are high.

Findings and status of Scientific Study or accomplishments of Science Education Activity during the reporting year (maximum 4000 characters):

DNA extraction has been completed, sequencing is underway.

For Scientific Studies (not Science Education Activities), were any specimens collected and removed from the park but not destroyed during analysis?

No

Funding specifically used in this park this reporting year that was provided by NPS (enter dollar amount):

\$0

Funding specifically used in this park this reporting year that was provided by all other sources (enter dollar amount):

\$0

List any other U.S. Government Agencies supporting this study or activity and the funding each provided this reporting year:

Paperwork Reduction Act Statement: A federal agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. Public reporting for this collection of information is estimated to average 1.625 hours per response, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the forms. Direct comments regarding this burden estimate or any aspect of this form to Dr. John G. Dennis, Natural Resources (3127 MIB), National Park Service, 1849 C Street, N.W., Washington, DC 20240.